Private Agenda and Re-election Incentives

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No. 14/13

BATH ECONOMICS RESEARCH PAPERS

Department of Economics

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November 20, 2013

Abstract

Consider a politician who has to take several decisions during his term in office. For each decision, the politician faces a trade-off between taking what he believes to be the right choice, thus increasing his chances of re-election, and taking the decision that increases his private gain but is likely to decrease his chances of re-election. Within this setting, we consider how different factors affect the incentives of the politician to take the right choice. In our results we find, among others, that the behavior such that the politician follows his private interests in the first periods of his term in office and then tries to please the electorate when elections approach is optimal if and only if he has either very high or very low decision making skills. Furthermore, we find that it is not true that a more demanding electorate produces more socially motivated politicians.

JEL Classification: D72, D81.

Keywords: Incentives, Political Agency Model, Private Agenda, Re-election.

*I would like to thank participants of the Theory Working Group in Bath for useful comments and discussions.

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1 Introduction

Politicians regularly face a trade-off between choosing what is best for their constituency and what is best for their own private benefit. On the one hand, choices that enhance the living standards of the citizens improve the politician's chances of re-election. On the other hand, the politician may be tempted instead to take choices that target his own private benefit. As Barro (1973) puts it, sources of private gain for a politician could be "payments from recipients of government contracts ... increased business with a politician's law firm, promises of future employment ... provision of personal services ...".

In this paper we consider a politician in office who has to take several decisions before the next elections. Before taking each decision, he has a prior on what the socially optimal alternative is (the right decision). On top of that, he has a private interest in choosing a particular option (the selfish decision), not necessarily the same as the right decision. After each decision, it is known whether the politician took the right decision or not. After all decisions are taken, the politician is re-elected if and only if he took the right decision a certain number of times. We study how two distinct factors affect the politician's incentives to choose what he believes to be the right decision. These factors are, first, how the politician is himself: how much he enjoys private gain, how good a decision maker he is and how much he desires to be re-elected, and, second, the electoral setting: how long each term is and how demanding citizens are.

In our analysis we obtain three main results. First, if the politician is a good enough decision maker and he desires to be re-elected enough, he takes what he believes to be the right decisions regardless of how large his private interests are. This is because there are times when the right decision coincides with the selfish decision. Hence, if the politician can to some degree guarantee himself re-election because of being a good decision maker and if his desire to be re-elected is sufficiently high, it is optimal for him to simply wait for the times when the right decision coincides with the selfish one.

Second, we find that if the politician takes the selfish decision, whether he does so at the beginning of his term in office or at the end depends non-monotonically on how good a decision maker he is. In particular, a good decision maker can start-off by taking the selfish decision to then take what he believes to be the right decision when elections approach. A bad decision maker cannot be sure of what the right decision is. Thus, he believes that re-election is unlikely regardless of how he behaves. Hence, although the politician wants to be re-elected he also wants to make sure he enjoys the private benefit from taking the selfish decision. Therefore, he starts off by taking the selfish decision and then tries to improve his chances of re-election by taking what he believes to be the right decision. A politician who is neither a good decision maker nor bad one needs to be more cautious and start off by choosing what he believes to be the right decision in order the improve his chances of re-election. Only if the politician has the public backing, he will then start choosing according to his private interests.

Third, we show that how demanding the electorate is (how much citizens tolerate wrong decisions) has an ambiguous effect on the incentives of the politician. An electorate that is not too demanding creates little incentives for the politician to choose what he believes to be the right decision as the politician's chances of re-election are high regardless of his performance. However, a very demanding electorate may cause a publicly motivated politician to behave in a selfish way as his chances of re-election are slim given how hard it is to please the voters.

The economic literature analysing political processes has its roots in Downs (1957). The politician's trade-off between private and public interests is usually referred to as has the political agency model, pioneered by Barro (1973) and Ferejhon (1986). In this literature, the relationship between the citizens and the politician is the same as that of a principal and an agent in the classic principal agent problem; citizens hire the politician to take certain decisions, the politician can shirk by taking the choices that increase his personal gain and citizens try to avoid this by not re-electing.

In this paper, we consider the political agency model as just described but, as opposed to previous literature, we allow for several decisions to be taken per term. This permits us to characterize and understand the specific decision rules that the politician may employ. In particular, we are interested in understanding when the politician takes socially motivated decisions as opposed to selfish ones, and why these decisions are sometimes taken at the beginning of the politician's term in office and other times they are taken at the end of his term before elections (recall the Kansas farmer's quote "what have you done for me lately", found for instance in Acemoglu and Robinson (2012) or Ferejhon (1986), see also Smart and Sturm (2007), Ferraz and Finana (2005), Pettersson-Lidbom (2006) or Besley and Burgess (2002) for empirical references).[1] Furthermore, we aim at understanding how demanding the electorate is affects the politician's incentives to take the right decision.

In our paper, and as opposed to Ferejhon (1986), we focus our attention on the current politician in power and on how he solves the trade-off between public and private interests. Moreover, our focus is not on who wins each election and on what are the political views of the winner (as in Van Weelden (2013)), but rather on how the winner takes decisions depending

[1]Most of this empirical literature assumed that politician has a maximum number of terms. Hence, the standard prediction of the political agency model is that the politician shirks when he is in his last term in office. In our model, there is no term limit and shirking occurs because there are multiple decisions per term. Moreover, in our paper the politician chooses not only whether to shirk or not but also when.

on his own characteristics and that of the electorate. On top of that, unlike previous political agency models, we do not need to consider different settings depending on whether or not the politician's characteristics are common knowledge or private knowledge (as in, for instance, Bernhardt et al. (2009)), as citizens only care about the quality of the politician's decisions, not on what motivated him to take each decision.

Previous literature has also looked at the role of commitment in elections. With commitment, the politician chooses the decisions that he will take while in office at the beginning of his term. This has shown to suffer from time inconsistency problems (Alesina (1998)) and, on top of that, it leaves open questions about the politician's reputation and how the citizens can punish candidates with unfulfilled promises (Aragonès et al (2007)). Instead, in our model citizens evaluate the performance of his politician according to the decisions he took. Thus, there is no role for commitment as only actual events instead of promises matter for re-election.

The rest of the paper is organized as follows. In Section 2 we introduce the model. We present our main results in Section 3. In Section 4 we discuss our results more in depth. Finally, Section 5 concludes. All mathematical proofs are presented in the Appendix.

2 The Model

There are $T \in \{1, \ldots, \infty\}$ time periods, where T represents the length of each term and it measures how many decision the politician has to take between elections. At each time $t \in \{1, \ldots, T\}$, the state of nature can take two values, $s^t \in \{0, 1\}$, both equally likely. The state of nature represents what is the socially optimal decision at a certain point in time (the right decision). At each t and before knowing the realization of s^t, the politician has to take a decision, $d^t \in \{0, 1\}$. Prior to taking each decision, however, the politician receives a signal $\theta^t \in \{0, 1\}$ about the state of nature. The signal θ^t is interpreted as what the politician believes to be the right decision. The signal θ^t has quality $q \in \left[\frac{1}{2}, 1\right]$ for all t where q represents how good a decision maker the politician is. In particular, for all t

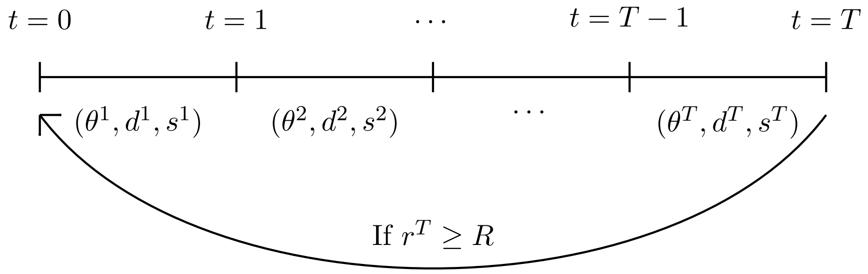
$$\Pr\left(s^t = 0 | \theta^t = 0\right) = \Pr\left(s^t = 1 | \theta^t = 1\right) = q.$$

At the end of each time period t the realization of s^t is known. If for a given t we have that $d^t = s^t$, we say that at time t the politician took the right decision. Let $r^t \in \{0, \ldots, t\}$ be the number of times the politician took the right decision up to time t included, that is, $r^t = \#\{n \in \{1, \ldots, t\} \ / \ d^n = s^n\}$.

At the end of period T voters decide whether or not to re-elect the politician. If the politician is re-elected then the game restarts, if not, the game ends. We assume that citizens re-elect the politician if and only if he took the right decision at least $R \in \{0, \dots, T\}$ times, where R is fixed and common knowledge and represents how demanding citizens are. That is, the politician is kept in power if and only if $r^T \geq R$. [2]

The game we just described is illustrated in Figure 1.

Figure 1: The Game



We assume that the politician enjoys being popular among the electorate. We represent this in the model by the fact that if the politician takes the right decision then his utility increases by $\frac{1}{T}$ units. On top of popularity, the politician has its own private agenda. In particular, the politician receives extra utility $\frac{\alpha}{T} \geq 0$ whenever he takes the decision 1 (the selfish decision). Finally, we assume that the politician discounts the utility of future elections at a rate $\beta \in (0, 1)$.[3]

Define $\frac{1}{T}u(s^t, d^t)$ as the utility the politician receives in period t given s^t and d^t. Following the description above we have that

$$u(s^t, d^t) = \begin{cases} 1 & \text{if } d^t = s^t = 0, \\ 1 + \alpha & \text{if } d^t = s^t = 1, \\ \alpha & \text{if } d^t \neq s^t = 0, \\ 0 & \text{if } d^t \neq s^t = 1. \end{cases}$$

Let $d^t : \{0, \dots, t-1\} \times \{0, 1\} \to \{0, 1\}$ be the plan of the politician such that his decision

[2]Note that the role of the electorate in our model is a passive one. In our analysis we consider how different values of T and R affect the politicians decision making incentives but voters are not strategic players in our model. In Section 4 we discuss this issue in more depth.

[3]The fact that both the utility from popularity and the utility from following his private agenda are divided by T is made to facilitate the comparison between different electoral settings that differ in the value of T. The discount factor β is applied not to future periods but to future elections; this again is to facilitate comparisons between different settings and to have β as a measure of how much the politician wants to be re-elected. Furthermore, note that the politician does not derive utility from holding office per se as his only sources of utility are popularity and private agenda.

at time t is given by $d^t(r^{t-1}, \theta^t)$ for all t. Note that in an abuse of notation we also refer to d^t as the realization of $d^t(r^{t-1}, \theta^t)$. Let $u^E(\theta^t, d^t)$ be the expected value of $u(s^t, d^t)$ at time t after θ^t is known. Thus, we can write

$$u^E(\theta^t, d^t) = \begin{cases} q & \text{if } d^t = \theta^t = 0, \\ q + \alpha & \text{if } d^t = \theta^t = 1, \\ \alpha + (1 - q) & \text{if } d^t \neq \theta^t = 0, \\ (1 - q) & \text{if } d^t \neq \theta^t = 1. \end{cases}$$

Let $u^E(d^t)$ be the expected value of $u^E(\theta^t, d^t)$ before the realization of θ^t is known. Finally, define U^E as the maximum expected discounted utility the politician receives from playing the game (i.e. the continuation value), we have that U^E is given by

$$U^E = \max_{\{d^t\}_{t=1}^{t=T}} \left\{ \frac{1}{T} \sum_{t=1}^{T} u^E(d^t) + \Pr\left(r^T \geq R\right) \beta U^E \right\}.$$

Given that the plan d^t for all t is contingent on all the possible values of θ^t and r^{t-1}, it is irrelevant whether the politician chooses the plan d^t at time t after knowing θ^t or at the beginning of the game before knowing θ^1. Thus, for simplicity we assume that the politician chooses $\{d^t\}_{t=1}^{t=T}$ at the beginning of the game.[4]

Note that at any t, if $\theta^t = 1$ then it is utility improving for the politician to decide $d^t = 1$: if $d^t = 1$ then the politician's one-period expected utility is $q + \alpha$ while if $d^t = 0$ then the politician's one-period expected utility is $1 - q$, which is smaller than $q + \alpha$ for any $\alpha \geq 0$ as $q \in \left[\frac{1}{2}, 1\right]$. Moreover, the chances that the politician is re-elected are higher by reporting $d^t = 1$ than by taking the decision $d^t = 0$ whenever $\theta^t = 1$ as $q \in \left[\frac{1}{2}, 1\right]$. Thus, if the politician receives signal 1 his optimal plan, in the sense that it maximizes his present and future expected utility, is to decide 1. Therefore, from now on we assume that the plan of the politician is such that $d^t(r^{t-1}, 1) = 1$ for all t and all r^{t-1}.

If at a given t we have that $\theta^t = 0$, whether or not the politician chooses $d^t(r^{t-1}, 0) = 0$ or $d^t(r^{t-1}, 0) = 1$ depends on the parameters of the model and the value of r^{t-1}. The target our analysis is to identify this dependence. We refer to the plan $d^t(r^{t-1}, 0) = 0$ as the honest plan, as the leader chooses what he believes to be the right decision even though it goes against his private benefit. If the politician chooses a plan with $d^t(r^{t-1}, 0) = 0$ we say that he is honest at time t for given r^t. Otherwise, if $d^t(r^{t-1}, 0) = 1$, we say that the politician

[4] Note that this does not mean that the politician commits to a certain sequence of plans $\{d^t\}_{t=1}^{t=T}$. The politician can choose any plan d^t at time t but, given that d^t is contingent on all relevant information up to time t, this plan is no different than the one he would have chosen at the beginning of the game. Likewise, this assumption poses no time consistency problems.

takes the selfish decision. To simplify exposition, if the politician is indifferent between being honest or not we assume he is honest.

3 Analysis

In our analysis we proceed by studying first the simplest case where $T = 1$, that is, there is only one decision to be taken before each election. In this case there are two possibilities, either $R = 0$, meaning that citizens always re-elect the politician regardless of his performance, or $R = 1$, meaning that the politician is re-elected if and only if he takes the right choice. The setting with $T = 1$ serves us as a benchmark case that facilitates the understanding of the model before moving to situations where $T > 1$.

After we present the analysis of the case where $T = 1$, we move on to study the case where $T = 2$; two decisions are taken before each election. We refer to the situation where $T = 2$ as the canonical case as it is the simplest case that allows us to study the trade-offs we are interested in. As we discuss in Section 4, a situation where $T \geq 3$ does not improve our understanding of the politician's incentives in any significant way when compared with the situation where $T = 2$.

When $T = 2$, there are three possible levels of how demanding citizens are. If $R = 0$ then citizens always re-elect the politician. If $R = 1$ then citizens re-elect the politician if he took at least one right decision. We believe this to be the most realistic and interesting setting; the politician can decide whether to take what he believes to be the right decision or to take the selfish decision, when to take each decision and, moreover, he can condition the second decision he takes on how the first one fared. If $R = 2$ then citizens re-elect the candidate if and only if he always took the right decision.

3.1 $T = 1$

If $T = 1$ then there are only two possible plans for the politician; he can either choose what he believes to be the right decision, H (honest plan), or he can simply follow his private interest, D. In particular, the two possible plans available are:

- H: $d^1(0, 0) = 0$.

- D: $d^1(0, 0) = 1$.

Note that we assume $d(r^t, 1) = 1$ for all r^t throughout the paper as this plan dominates any other plan whenever the politician receives signal 1. Hence, $d^1(0, 1) = 1$.

3.1.1 $T = 1,\ R = 0$

If $R = 0$ then the politician is always re-elected and, hence, we can write

$$U^E = \underbrace{\frac{1}{2}\max\left\{\underbrace{q}_{\text{H}}, \underbrace{\alpha + (1-q)}_{\text{D}}\right\}}_{\theta^1=0} + \frac{1}{2}\underbrace{(q+\alpha)}_{\theta^1=1} + \beta U^E.$$

In words, if $\theta^1 = 0$, which happens with probability $\frac{1}{2}$, then the politician's continuation value with plan H is equal to his expected utility at time $t = 1$, given by q, plus the discounted continuation value. If $\theta^1 = 0$ and the politician follows plan D then his expected utility is given by $\alpha + (1-q)$. If $\theta^0 = 1$ then both plans H and D prescribe $d(0,1) = 1$ and, hence, the politicians expected utility is given by $q + \alpha$. We have the following result:

Proposition 1. *If $T = 1$ and $R = 0$ then the optimal plan is given by*

$$d^1(0,0) = \begin{cases} 0 & \textit{if } q \geq \frac{1+\alpha}{2} \\ 1 & \textit{otherwise.} \end{cases}$$

As we can deduce from Proposition 1, whether the politician is honest or not only depends on his one-period gains from being so. This is not surprising as the politician is always re-elected and, hence, he simply chooses the one-period utility maximizing action. The discount factor does not play any role in Proposition 1 as expected, the politician is certain to be re-elected and, hence, only his utility in the present period matters.

3.1.2 $T = 1,\ R = 1$

If $R = 1$ then the politician gets re-elected if and only if he takes the right decision. Thus, since $q \geq \frac{1}{2}$ if he receives signal $\theta = 0$ then by choosing 0 he increases his chances of re-election but loses out on his private gain α. In this case we have that

$$U^E = \underbrace{\frac{1}{2}\max\left\{\underbrace{q + \beta q U^E}_{\text{H}}, \underbrace{\alpha + (1-q) + \beta(1-q)U^E}_{\text{D}}\right\}}_{\theta^1=0} + \frac{1}{2}\underbrace{\left(q + \alpha + \beta q U^E\right)}_{\theta^1=1}.$$

Note that as opposed to the case where $R = 0$, with $R = 1$ the continuation value enters the right hand side of the equation with factor q or $1-q$, depending on whether the politician follows the recommendation of his private signal or not. If $\theta^1 = 0$ then under plan H the politician chooses 0 and his chances of re-election are q. However, if $\theta^1 = 0$ and the politician employs plan D, he does not take what he believes to be the right decision and, in this case, his chances of re-election are $1-q$. Since, $q \in \left[\frac{1}{2}, 1\right]$ we have that $q \geq 1-q$ and the politician's chances of re-election are higher when he follows the honest plan H. We have the following result:

Proposition 2. *If $T = 1$ and $R = 1$ then the optimal plan is given by:*

- *If $q \geq \frac{3}{4}$ and $\beta \geq \frac{2}{4q-1}$ then*

$$d^1(0,0) = 0.$$

- *If $q < \frac{3}{4}$ or $\beta < \frac{2}{4q-1}$ then*

$$d^1(0,0) = \begin{cases} 0 & \textit{if } \alpha \leq \frac{4q-2}{2-\beta(4q-1)}, \\ 1 & \textit{otherwise.} \end{cases}$$

Proposition 2 reveals several insights. As expected, a better politician (higher q) who is more patient (higher β) and whose private gain is relatively small (low α) is more likely to be honest. What is revealing in Proposition 2 is the fact that if both q and β are high enough then regardless of α the politician is honest. In other words, there exists values of q and β such that for all α the politician chooses $d^1(0,0) = 1$. This is because if the politician can to some degree guarantee himself re-election because of a high q and if he is patient enough because of a high β, then even if α is high it is optimal for the politician to be honest, $d^1(0,0) = 0$, and simply wait for the periods where $\theta^1 = 1$, i.e. the periods where the right decision coincides with the selfish decision.

In Figure 2 we illustrate the result in Proposition 2 for two particular values of β. As expected, the area were the politician is honest is greater the higher the discount factor. The plot in the right hand side shows a situation where for high levels of q the politician is honest regardless of his private interests α. As Proposition 2 implies, the curve on the right hand figure has an asymptote at $q = \frac{3}{4}$.

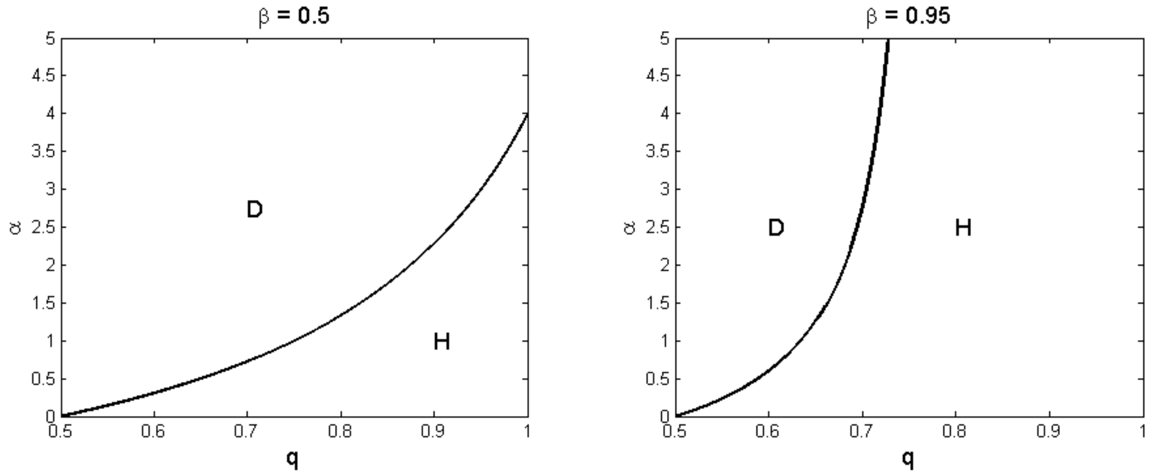
3.2 $T = 2$

In this section we consider the case where $T = 2$, that is, the politician has to take two decisions before he is up for re-election. If $T = 2$ then there are eight possible plans maximizing U^E, we label those as HH, DD, HD, DH, AHD, ADH, NHD and NDT. In detail,

- HH: $d^1(0,0) = 0$ and $d^2(r^1, 0) = 0$ for all r^1.

- DD: $d^1(0,0) = 1$ and $d^2(r^1, 0) = 1$ for all r^1.

Figure 2: $T = 1, R = 1$



- HD: $d^1(0,0) = 0$ and $d^2(r^1, 0) = 1$ for all r^1.

- DH: $d^1(0,0) = 1$ and $d^2(r^1, 0) = 0$ for all r^1.

- AHD: $d^1(0,0) = 0$, $d^2(0,0) = 0$ and $d^2(1,0) = 1$.

- ADH: $d^1(0,0) = 1$, $d^2(0,0) = 0$ and $d^2(1,0) = 1$.

- NHD: $d^1(0,0) = 0$, $d^2(0,0) = 1$ and $d^2(1,0) = 0$.

- NDH: $d^1(0,0) = 1$, $d^2(0,0) = 1$ and $d^2(1,0) = 0$.

Plans HH and DD can be seen as the counterparts of plans H and D in the previous section. Under plan HH the politician is always honest as he takes the decision that he believes to be the right one at both $t = 1, 2$. On the other hand, with plan DD the politician always takes the selfish decision.

With plan HD the politician starts off be being honest to then take the selfish decision. On the contrary, under plan DH the politician starts off by taking the selfish decision and then he is honest in the second period. Neither of these plans condition the decision at time $t = 2$ with whether or not the politician takes the right the decision at time $t = 1$. As we shall show later on, these two plans are always dominated by one of the other six plans.

Plans AHD and ADH condition the politician's decision at time $t = 2$ on whether or not he takes the right decision at time $t = 1$. Both plans prescribe that, if the politician takes the right the decision at time $t = 1$, he should take the selfish decision at $t = 2$. However, if the politician takes the wrong decision at time $t = 1$ then both plans prescribe the politician to be honest at time $t = 2$. Under plan AHD the politician starts off by taking what he believes to be the right decision and, only if his signal was right, he then takes the selfish decision. On the other hand, the plan ADH starts off by the politician taking the selfish decision at $t = 1$. If this did not happen to be the right choice, the politician is then honest at $t = 2$. As we shall show, these two plans can be optimal only in the case where $R = 1$.

Finally, plans NHD and NDH also condition the decision of the politician at time $t = 2$ on whether or not he took the right decision at time $t = 1$. However, as opposed to the plans AHD and ADH, both plans prescribe that if the politician takes the right the decision at time $t = 1$, he should be honest at $t = 2$ and take the decision that he believes to be the right one. Under plan NHD the politician starts off by being honest and, only if he takes the right decision at $t = 1$, he is honest again at $t = 2$. On the other hand, the plan NDH starts off by the politician following his private interests and, if by chance he takes the right decision at $t = 1$, he his honest at time $t = 2$. As we prove later on, these two plans can be optimal only in the case where $R = 2$.

We remind the reader that we are assuming $d(r^t, 1) = 1$ for all r^t throughout our analysis as this plan dominates any other plan whenever the politician receives signal 1.

3.2.1 $T = 2, R = 0$

Assume that $T = 2$ and $R = 0$. Whenever the politician receives signal $\theta = 0$, the one-period utility from following his signal is q while the utility from deciding according to his private interests is $\alpha + (1 - q)$. Hence, as the politician always is re-elected, if $q \geq \alpha + (1 - q)$ then it is optimal for him to follow the plan HH as this plan maximizes his period per period utility. If, on the other hand, $q < \alpha + (1 - q)$ then it is optimal for the politician to follow the plan DD. Therefore, in this case there are only two possible plans maximizing U^E, HH and DD, as any other plan is dominated by either of these two. Thus, we have that

$$\begin{aligned} U^E &= \frac{1}{2}\left[\underbrace{\frac{1}{2}\max\left\{\underbrace{q}_{\text{HH}}, \underbrace{\alpha + (1-q)}_{\text{DD}}\right\}}_{\theta^1=0} + \frac{1}{2}\underbrace{(q+\alpha)}_{\theta^1=1} + \right. \\ &\qquad \left. \underbrace{\frac{1}{2}\max\left\{\underbrace{q}_{\text{HH}}, \underbrace{\alpha + (1-q)}_{\text{DD}}\right\}}_{\theta^2=0} + \frac{1}{2}\underbrace{(q+\alpha)}_{\theta^2=1}\right] + \beta U^E, \end{aligned}$$

which leads to the following result:

Proposition 3. *If $T = 2$ and $R = 0$ then the optimal plan is given by*

$$d^t(r^t, 0) = \begin{cases} 0 & \text{if } q \geq \frac{1+\alpha}{2} \\ 1 & \text{otherwise.} \end{cases}$$

for $t = \{1, 2\}$.

Proposition 3 states exactly the same result as Proposition 1. This is not surprising as in both cases $R = 0$ and, hence, the politician is re-elected regardless of his performance. Therefore, the optimal plan is simply the plan that maximizes the politician's one-period expected utility. As in the case where $T = 1$, the discount factor does not play any role; the politician is certain to be re-elected and, hence, only his utility in the present period plays any role.

3.2.2 $T = 2$, $R = 1$

Assume now that $R = 1$, this case is more intricate than any of the situations considered so far. Apart from the plans where the politician is always honest, HH, or always dishonest, DD, now there is also the possibility that the politician finds it optimal to use a plan where his choice in period $t = 2$ is contingent on whether or not he takes the right decision at time $t = 1$. Out of the eight possible plans, if $R = 1$ only four of them are not dominated, this is our next result.

Lemma 1. *If $T = 2$ and $R = 1$ then the plans HD, DH, NHD and NDH are dominated by HH, DD, AHD or ADH.*

Intuitively, the plans HD and DH are never optimal as it is best for the politician to be fully honest, HH, to condition his honesty for the second period on how he fared in the first period, AHD, ADH, NHD and NDH, or to never by honest, DD. The politician may find it optimal to condition his honesty for the second period on how he fared in the first period: if his one-period utility is greater by following his private interests than by taking what he believes to be the right decision, then if he takes the right decision at time $t = 1$ he has no incentives to continue being honest as he is going to get re-elected regardless of the outcome of his decision at time $t = 2$.

The plans NHD and NDH are never optimal as if the politician receives more one-period utility by being honest then he maximizes his utility by being honest at both $t = 1, 2$. Similarly, if the politician receives more one-period utility by not being honest then a plan where he is honest after taking the right choice at $t = 1$ is always dominated by a plan where he is not honest under the same circumstances.

From Lemma 1, we can obtain the following result:

Proposition 4. *If $T = 2$ and $R = 1$ then the optimal plan is given by:*

- *If $\alpha \leq 2q - 1$ then*

$$S = HH.$$

- *If $\alpha > 2q - 1$, $q \geq \frac{5}{8}$ and $\beta \geq \frac{3-2q}{q(11-8q)-2}$ then*

$$S = AHD.$$

- *If $\alpha > 2q - 1$ but either $q < \frac{5}{8}$ or $\beta < \frac{3-2q}{q(11-8q)-2}$ then if*

$$\alpha \leq \frac{3 + q(q(4 + 2\beta) - 8 - \beta)}{q(2 + 11\beta - 8\beta q) - 3 - 2\beta}$$

then

$$S = AHD.$$

- *If $q < \frac{9}{16}$ or $\beta < \frac{4}{-5+16q}$, and*

$$\alpha > \frac{q(8 - 2\beta) - \beta - 4}{4 + 5\beta - 16\beta q}$$

then

$$S = DD.$$

- *Otherwise,*

$$S = ADH.$$

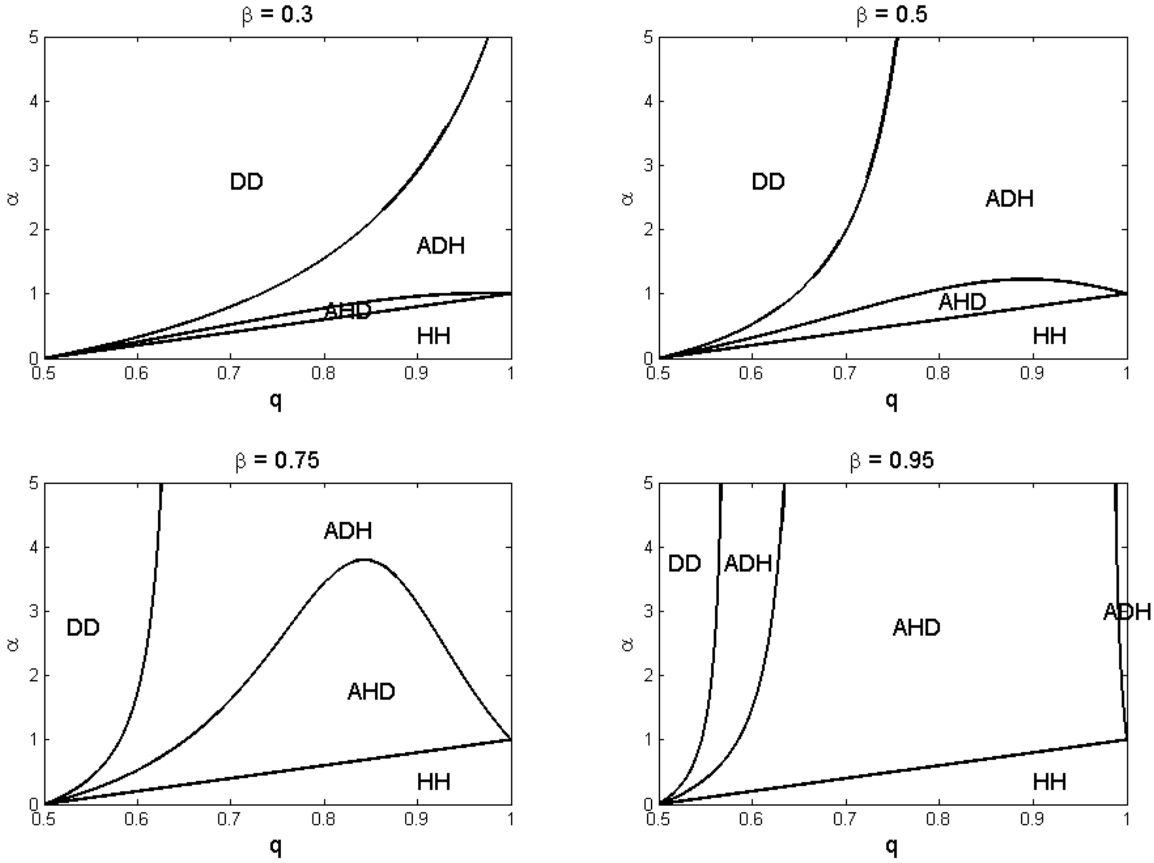
In words, Proposition 4 states the following. If the politician's one-period utility is higher by being honest than by taking the selfish decision, the optimal plan is for him to be honest at both periods, HH. Otherwise, if either he is both a good decision maker and patient or if his private interests are not too high then he starts off by being honest in hopes of taking the right choice to ensure re-election. The politician then, if he takes the right decision at time $t = 1$, takes the selfish decision at time $t = 2$. On the contrary, if the politician takes the wrong decision at time $t = 1$, he continues to be honest at time $t = 2$ (plan AHD). In this situation, the politician wants to ensure re-election and, hence, if necessary he is honest at both periods. If either the politician is not a good decision maker or he is not patient enough, and his private interests are sufficiently high, then the optimal plan involves him taking the selfish decision at both periods, DD.

Finally, if either the politician is not a good decision maker or he is not patient and his private interests are moderate, he starts off by taking the selfish decision and, if he does not have the electorate's backing because he took the wrong decision at $t = 1$, he is honest at time $t = 2$, i.e. the plan ADH. This is the type of behavior that empirical literature on the political agency model has tried to identify (see for instance Smart and Sturm (2007), Ferraz and Finana (2005) or Pettersson-Lidbom (2006)). Furthermore, this behaviour is supported by the view that the electorate has short memory and, thus, more recent events are more relevant for re-election.[5] In our model, if the plan ADH is optimal it is not because of a memory effect as voters remember both periods $t = 1$ and $t = 2$ equally well.

We plot the result in Proposition 4 in Figure 3 for four different values of β. The most notable finding can be seen when $\beta = 0.75$ and $\beta = 0.95$. The plan where the politician starts off by taking the selfish decision and then, if he does not have the electorate's backing, he is honest at time $t = 2$ (the plan ADH) is optimal if either q is low (but not low enough as to make the plan DD optimal) or high enough. For moderate values of q the optimal plan is given by AHD. That is, whether the politician follows plan ADH or AHD depends non-monotonically on the value of q. The intuition for this result is the following. A good decision maker can start off by taking the selfish decision to then by honest only when elections approach, as he is somewhat certain that he will take the right decision at time $t = 2$, guaranteeing himself re-election. A bad decision maker receives a signal that is not very trustworthy. Hence, the differences in the probability of being re-elected when he follows his signal and when he ignores it are not too acute. That is, although the politician may value re-election significantly he believes that re-election is unlikely regardless of how he decides. Thus, he can guarantee himself the private gain α by barely decreasing his chances of re-election if he follows the plan ADH. If the politician instead chooses the plan AHD, there is a high chance that he will be honest at both periods, possibly not enjoying α in neither, and still having a low chance of being re-elected. Therefore, the politician starts off by taking the selfish choice and, if he is wrong at time $t = 1$, he then tries to improve his chances of re-election by being honest. Finally, a politician who is neither a good decision maker nor bad one needs to be more cautious and start off by begin honest in order the improve his chances of re-election. Only if the politician has the public backing because he took the right decision at time $t = 1$, he then takes the selfish decision.

[5] Recall the Kansas farmer's quote "What have you done for me lately?". For a formal analysis see, for instance, Sarafidis (2007).

Figure 3: $T = 1, R = 1$



3.2.3 $T = 2, R = 2$

Assume now that $R = 2$. In this case the politician is re-elected if and only if he takes the right decision at both time periods. As in the case where $R = 1$, the politician may find it optimal to have his choice in period $t = 2$ contingent on whether or not he takes the right decision at time $t = 1$. For instance, the politician may derive more one-period utility from following his private agenda but be very interested in re-election (high β). Hence, a possibility is that the politician starts off by being honest, if he took the wrong decision at time $t = 1$ he then takes the selfish decision in the second period as he is sure re-election is not going to happen.

Out of the eight possible plans, if $R = 2$ only four of them are not dominated:

Lemma 2. *If $T = 2$ and $R = 2$ then the plans HD, DH, AHD and ADH are dominated by HH, DD, NHD or NDH.*

The plans HD and DH are never optimal for the same reasons as when $R = 1$. The plans AHD and ADH are never optimal as if the politician receives more one-period utility from being honest then he maximizes utility by being honest at both $t = 1, 2$. However, if the politician receives more one-period utility by taking the selfish decision then a plan where he is honest after taking the wrong choice at $t = 1$ is always dominated by a plan where he is not honest under the same circumstances, as once the politician takes one wrong decision he is not re-elected.

Using the statement in Lemma 2, we obtain the following result:

Proposition 5. *If $T = 2$ and $R = 2$ then the optimal plan is given by*

- *If $\alpha \leq 2q - 1$ then*

$$S = HH$$

- *If $\alpha > 2q - 1$ and $q \geq \frac{1}{16}\left(5 + \sqrt{57}\right)$ and $\beta \geq \frac{1+2q}{q(8q-3)}$ then*

$$S = NHD$$

- *If $\alpha > 2q - 1$ but either $q < \frac{1}{16}\left(5 + \sqrt{57}\right)$ or $\beta < \frac{1+2q}{q(8q-3)}$ then if*

$$\alpha \leq \frac{q(q(4 + 2\beta) - \beta) - 1}{1 + 2q - q(8q\beta - 3\beta)}$$

then

$$S = NHD$$

- *If $q < \frac{11}{16}$ or $\beta < \frac{4}{-5+16q}$, and*

$$\alpha > \frac{q(8 + 6\beta) - 3\beta - 4}{4 + \beta(7 - 16q)}$$

then

$$S = DD$$

- *Otherwise,*

$$S = NDH$$

In words, Proposition 5 states the following. Similarly to Proposition 4, if the politician's one-period utility is higher by reporting honestly than by taking the selfish action, the optimal plan is for him to be honest at both periods, HH. Otherwise, if either he is both a good decision maker and patient or if his private interests are not too high, he will start off by being honest. If the politician takes the right decision at time $t = 1$ he then tries to go for re-election by begin honest also at time $t = 2$. On the other hand, if the politicians is wrong at $t = 1$ then the fact that he will not get re-elected makes him pursue his private agenda at time $t = 2$. Hence, in this situation (plan NHD) the politician wants to ensure re-election and, therefore, he is honest in both periods unless he does not take the right decision at time $t = 1$. If either the politician is not a good decision maker or he is not patient, and his private interests are high enough, then the optimal plan involves him taking the selfish decision in both periods, DD.

Finally, if either the politician is not a good decision maker or he is not patient and his private interests are moderate, he starts off by taking the selfish decision. If he does by chance take the right decision at $t = 1$ even though he decided against his signal, the politician tries to get re-elected by being honest at $t = 2$, i.e. the plan NDH. This plan shows the same type of behavior as the plan ADH: the politician starts off by taking the selfish decision and then takes the action that maximizes his chances of re-election in the second period, if re-election is still possible but not certain.

We plot the result in Proposition 5 in Figure 4 for four different values of β. The most notable difference between figures 4 and 3 lies on the fact that the plan NDH (plan ADH in Figure 3) does not show the non-monotonicity observed in Figure 3. The reason for this is that if $R = 2$ a politician that is a good decision maker can non-longer delay being honest to period $t = 2$ as if he wants re-election he needs to take the right decision in both periods.

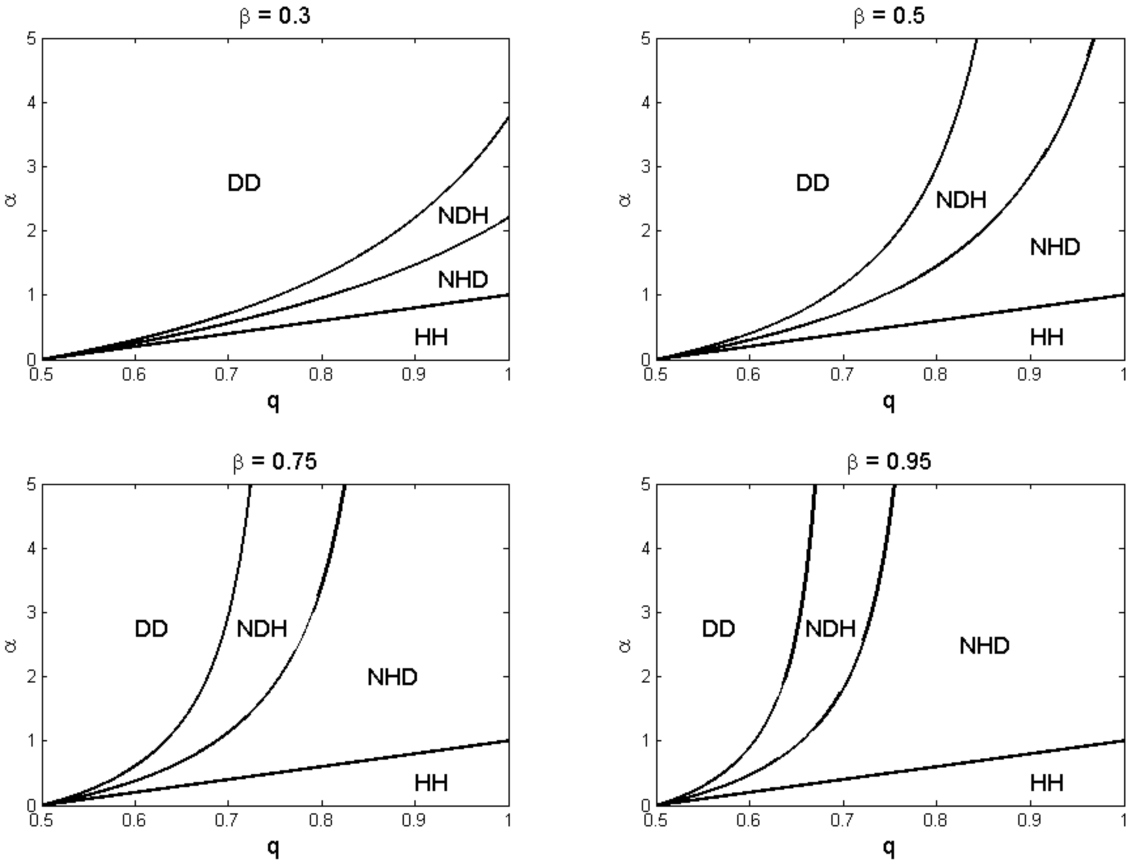
4 Discussion

4.1 Comparison between Different Levels of R

Next we explore the question of whether a more demanding electorate (higher R) creates more incentives for the politician to be honest. To understand this issue, we look first at what is the expected number of times the politician takes the right decision under each of the different plans when $T = 2$.

Proposition 6. *Assume that $T = 2$ The expected number of times that the politician takes*

Figure 4: $T = 2, R = 2$



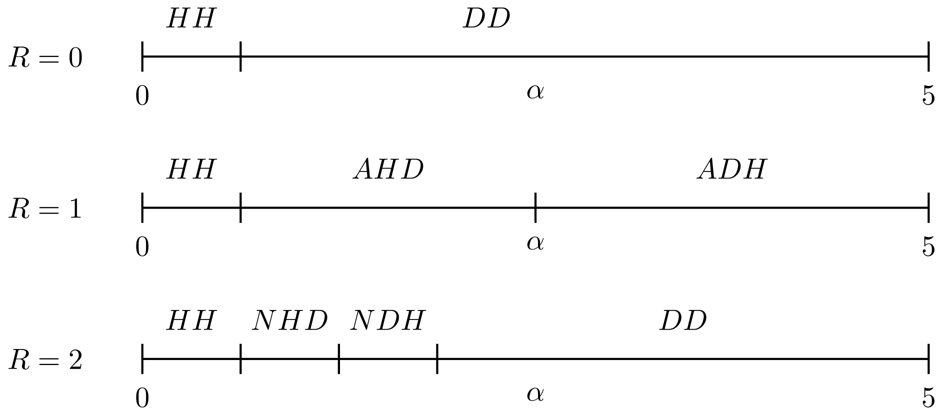
the right decision under each plan is given by

$$E(r^t) = \begin{cases} 2q & \text{if } HH, \\ q\left(\frac{5}{2} - q\right) & \text{if } AHD, \\ \frac{3}{4} + \frac{q}{2} & \text{if } ADH, \\ \frac{1}{2} + q\left(\frac{1}{2} + q\right) & \text{if } NHD, \\ \frac{3}{4} + \frac{q}{2} & \text{if } NDH, \\ 1 & \text{if } DD. \end{cases}$$

Moreover, it is true that $2q \geq \frac{1}{2} + q\left(\frac{1}{2} + q\right) \geq q\left(\frac{5}{2} - q\right) \geq \frac{3}{4} + \frac{q}{2} \geq 1$.

Hence, if we use the result in Proposition 6 in combination with those in propositions 3, 4 and 5 we can deduce that it is not true that higher R implies that the politician has more incentives to be honest. For instance, for high values of β and low values of q, the value of R that creates the most incentives for the politician to be honest is non-monotonic in the value of α. This is better seen in the example depicted in Figure 5. As we can see there, for low values of α a more demanding society, $R = 2$, creates better incentives for the politician to be honest while for high values of α a less demanding society, $R = 1$, is instead the one that creates better incentives. Not surprisingly, the situation where the politician is always re-elected regardless of how he performs in office, $R = 0$, is the one that creates the least incentives for the politician to be honest.[6]

Figure 5: Optimal Plans for $q = 0.6$ and $\beta = 0.95$.



In order to illustrate the fact that it is not true that a more demanding electorate creates better incentives for its politician, we have assumed high values of β and low values of q. This is not a requirement; it is possible to find examples where β is low and/or q is high such that it is true that a more demanding society does not provide with better incentives for the politician to be honest.

4.2 $T > 2$

For our main results we have assumed that $T = 2$, taking the situation when $T = 1$ as a benchmark case. If $T > 2$ then the analysis becomes much more intricate as in this case there are considerably more different plans for the politician to consider (for example, if $T = 3$ then there are 64 different plans). Moreover, we believe that our understanding of the incentives faced by the politician are not significantly different between the situations where $T = 2$ and the situations where $T > 2$. In our model, the politician faces a trade-off between private gain, social gain and re-election. This trade-off is very clearly represented when $T \geq 1$ already. The advantage of considering the case where $T = 2$ is that this situation allows us to get a better understanding of the different plans that the politician could employ.

[6] Using the classic principal agent model's terminology, in this example when α is high both $R = 0$ and $R = 2$ fail to satisfy the incentive compatibility constraint: $R = 0$ implies that there is no return from being honest while $R = 2$ implies that the expected return from being honest is too small as it is too hard to achieve re-election.

Considering situations where $T > 2$ allows for more complex plans that are variations of the plans already considered when $T = 2$. For instance, if $T = 3$ and $R = 1$, the politician can follow a plan where he starts being honest and as soon as he guarantees himself re-election he then starts taking the selfish decision. This is the same idea underlying the plan AHD. A similarly thing can be said about other potential plans and different values of T and R; the basic trade-off the politician faces is already captured when studying the situation where $T = 2$.

4.3 What do voters prefer?

We have already seen the fact that it is not true that a higher R leads to the politician taking the socially optimal decision more often. However, a question remains on whether allowing for longer terms in office, represented in the model by a higher T, improves the incentives of the politician to take socially optimal decision. Our results allow us to conclude that the answer to the question of what are the optimal levels of T and R is dependent on the characteristics of the politician. For instance, if $q \geq \frac{1+\alpha}{2}$ then the politician always has incentives to take the socially optimal decision regardless of T and R. If $\alpha \leq \frac{4q-2}{2-\beta(4q-1)}$ then $T = 1$ and $R = 1$ ensures that the politician always takes the socially optimal decision. As we have seen, if q is low then being too demanding with the politician may have negative effects on the quality of his decisions. Similarly, a high T may allow a politician with a high q many periods of taking selfish decisions before he starts to be honest when elections approach, etc.

5 Conclusions

In this paper we study a setting where a politician has to take several decisions during his term in office. For each decision, the politician faces a trade-off between taking what he believes to be the right decision, thus increasing his chances of re-election, and taking the decision that increases his private gain but is likely to decrease his chances of re-election. In our results we characterize how factors like how good a decision maker the politician is, how strong his private interests are, and how much he wants to be re-elected, affect the politician's incentives to take socially optimal decisions. We also study how term length and how demanding citizens are affects the politician's decision making incentives.

In our results we find evidence for the behavior where a politician start his terms in office by taking the selfish decision and defer taking socially motivated decisions for later periods when re-election approaches. Crucially, the fact that the politician chooses to follow his private agenda first and then tries to take the right decision in order to be re-elected has no relation with the memory of the voters; this behavior is optimal because it ensures the politician's private gain while at the same time it provides him with certain confidence of being re-elected. In our analysis, we also found that it is not true that a more demanding electorate produces better politicians; if voters are very demanding then a politician who takes a wrong decision, even if he thought he was doing what is best for society, may have no incentives to continue taking socially optimal choices.

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A Appendix: Proofs

Proof of Proposition 1. If $T = 1$ and $R = 0$ then given that

$$U^E = \underbrace{\frac{1}{2}\max\left\{\underbrace{q}_{\text{H}}, \underbrace{\alpha + (1-q)}_{\text{D}}\right\}}_{\theta^1=0} + \frac{1}{2}\underbrace{(q+\alpha)}_{\theta^1=1} + \beta U^E,$$

we have

$$U^E = \max\left\{\underbrace{\frac{q+\frac{\alpha}{2}}{1-\beta}}_{\text{H}}, \underbrace{\frac{\alpha+\frac{1}{2}}{1-\beta}}_{\text{D}}\right\}.$$

Analyzing the conditions under which $\frac{q+\frac{\alpha}{2}}{1-\beta} \geq \frac{\alpha+\frac{1}{2}}{1-\beta}$ leads to the desired result. □

Proof of Proposition 2. If $T = 1$ and $R = 1$ then given that

$$U^E = \underbrace{\frac{1}{2}\max\left\{\underbrace{q + q\beta U^E}_{\text{H}}, \underbrace{\alpha + (1-q) + (1-q)\beta U^E}_{\text{D}}\right\}}_{\theta^1=0} + \frac{1}{2}\underbrace{\left(q + \alpha + q\beta U^E\right)}_{\theta^1=1},$$

we have

$$U^E = \max\left\{\underbrace{\frac{q+\frac{\alpha}{2}}{1-q\beta}}_{\text{H}}, \underbrace{\frac{\alpha+\frac{1}{2}}{1-\frac{1}{2}\beta}}_{\text{D}}\right\}.$$

Analyzing the conditions under which $\frac{q+\frac{\alpha}{2}}{1-q\beta} \geq \frac{\alpha+\frac{1}{2}}{1-\frac{1}{2}\beta}$ leads to the desired result. □

Proof of Proposition 3. Since

$$U^E = \frac{1}{2}\left[\underbrace{\frac{1}{2}\max\left\{\underbrace{q}_{\text{HH}}, \underbrace{\alpha+(1-q)}_{\text{DD}}\right\}}_{\theta^1=0} + \frac{1}{2}\underbrace{(q+\alpha)}_{\theta^1=1} + \underbrace{\frac{1}{2}\max\left\{\underbrace{q}_{\text{HH}}, \underbrace{\alpha+(1-q)}_{\text{DD}}\right\}}_{\theta^2=0} + \frac{1}{2}\underbrace{(q+\alpha)}_{\theta^2=1}\right] + \beta U^E,$$

we have that

$$U^E = \max\left\{\frac{q+\frac{\alpha}{2}}{1-\beta}, \frac{\alpha+\frac{1}{2}}{1-\beta}\right\}.$$

This is the same expression as in the proof in Proposition 1. Hence, the conditions under which each of the two plans is optimal is the same is in Proposition 1. □

Proof of Lemma 1. Let $U^E(S)$ be the value of U^E when a certain plan

$$S \in \{HH, FF, HF, FH, AHF, AFH, NHF, NFH\}$$

is employed. If the politician employs plan HH then it is true that

$$U^E(HH) = \frac{1}{2}\left[\left(\frac{1}{2}\underbrace{q}_{\theta^1=0} + \frac{1}{2}\underbrace{(q+\alpha)}_{\theta^1=1}\right) + \left(\frac{1}{2}\underbrace{q}_{\theta^2=0} + \frac{1}{2}\underbrace{(q+\alpha)}_{\theta^2=1}\right)\right] + \beta(q+(1-q)q)U^E.$$

Which implies

$$U^E(HH) = \frac{q+\frac{\alpha}{2}}{1-\beta(q+(1-q)q)}.$$

Proceeding in a similar fashion we have that

$$\begin{aligned}
U^E(DD) &= \frac{\alpha+\frac{1}{2}}{1-\beta\frac{3}{4}}, \\
U^E(HD) &= \frac{\frac{1}{2}\left[\left(q+\frac{\alpha}{2}\right)+\left(\alpha+\frac{1}{2}\right)\right]}{1-\beta\frac{1+q}{2}}, \\
U^E(DH) &= \frac{\frac{1}{2}\left[\left(\alpha+\frac{1}{2}\right)+\left(q+\frac{\alpha}{2}\right)\right]}{1-\beta\frac{1+q}{2}}.
\end{aligned}$$

If the politician employs plan AHD then it is true that

$$U^E = \frac{1}{2}\left[\left(\frac{1}{2}\underbrace{q}_{\theta^1=0}+\frac{1}{2}\underbrace{(q+\alpha)}_{\theta^1=1}\right)+q\underbrace{\left(\frac{1}{2}\underbrace{(\alpha+(1-q))}_{\theta^2=0}+\frac{1}{2}\underbrace{(q+\alpha)}_{\theta^2=1}\right)}_{d^1=s^1}+\right.$$

$$\left.(1-q)\underbrace{\left(\frac{1}{2}\underbrace{q}_{\theta^1=0}+\frac{1}{2}\underbrace{(q+\alpha)}_{\theta^1=1}\right)}_{d^1\neq s^1}\right]+\beta(q+(1-q)q)U^E.$$

Hence, we have the following:

$$U^E(AHD) = \frac{\frac{1}{2}\left[(1+(1-q))\left(q+\frac{\alpha}{2}\right)+q\left(\alpha+\frac{1}{2}\right)\right]}{1-\beta(q+(1-q)q)}.$$

Thus, proceeding as above

$$\begin{aligned}
U^E(ADH) &= \frac{\frac{1}{2}\left[\frac{3}{2}\left(\alpha+\frac{1}{2}\right)+\frac{1}{2}\left(q+\frac{\alpha}{2}\right)\right]}{1-\beta\frac{1+q}{2}},\\
U^E(NHD) &= \frac{\frac{1}{2}\left[(1+q)\left(q+\frac{\alpha}{2}\right)+(1-q)\left(\alpha+\frac{1}{2}\right)\right]}{1-\beta\frac{1+q}{2}},\\
U^E(NDH) &= \frac{\frac{1}{2}\left[\frac{3}{2}\left(\alpha+\frac{1}{2}\right)+\frac{1}{2}\left(q+\frac{\alpha}{2}\right)\right]}{1-\beta\frac{3}{4}}.
\end{aligned}$$

Therefore, if $q+\frac{\alpha}{2}\geq\alpha+\frac{1}{2}$ then as $q\in\left[\frac{1}{2},1\right]$ we have that $U^E(HH)\geq U^E(HD)=U^E(DH)$, $U^E(HH)\geq U^E(NHD)$ and $U^E(HH)\geq U^E(NDH)$. Similarly, if $\alpha+\frac{1}{2}\geq q+\frac{\alpha}{2}$ then $U^E(AHD)\geq U^E(NHD)$, $U^E(ADH)\geq U^E(HD)=U^E(DH)$, and $U^E(DD)\geq U^E(NDH)$ □

Proof of Proposition 4. Given the result in Lemma 1, it is true that

$$U^E = \max\{U^E(HH),U^E(DD),U^E(AHD),U^E(ADH)\}.$$

Hence, if $q+\frac{\alpha}{2}\geq\alpha+\frac{1}{2}$ then as $q+(1-q)q\geq\frac{1+q}{2}\geq\frac{3}{4}$ we have that $U^E(HH)\geq U^E(DD),U^E(AHD),U^E(ADH)$. Thus, if $q+\frac{\alpha}{2}\geq\alpha+\frac{1}{2}$ then the plan HH is optimal. However, if $q+\frac{\alpha}{2}\leq\alpha+\frac{1}{2}$ then it is easy to see that the plan AHD gives more continuation pay-off than the plan HH. Thus, the plan HH is optimal if and only if $q+\frac{\alpha}{2}\geq\alpha+\frac{1}{2}$, which can be rewritten as $\alpha\leq 2q-1$.

Proceeding in a similar fashion as above, checking the conditions under which each of the other three plans (DD, AHD and ADH) is optimal leads after some tedious algebra to the result in the proposition. □

Proof of Lemma 2. Solving for the value of $U^E(S)$ for each plan S in a similar way as in the proof of Proposition 4 we have:

$$
\begin{aligned}
U^E(HH) &= \frac{q+\frac{\alpha}{2}}{1-\beta q^2} \\
U^E(DD) &= \frac{\alpha+\frac{1}{2}}{1-\beta\frac{1}{4}} \\
U^E(HD) &= \frac{\frac{1}{2}\left[\left(q+\frac{\alpha}{2}\right)+\left(\alpha+\frac{1}{2}\right)\right]}{1-\beta\frac{q}{2}} \\
U^E(DH) &= \frac{\frac{1}{2}\left[\left(\alpha+\frac{1}{2}\right)+\left(q+\frac{\alpha}{2}\right)\right]}{1-\beta\frac{q}{2}} \\
U^E(AHD) &= \frac{\frac{1}{2}\left[(1+(1-q))\left(q+\frac{\alpha}{2}\right)+q\left(\alpha+\frac{1}{2}\right)\right]}{1-\beta\frac{q}{2}} \\
U^E(ADH) &= \frac{\frac{1}{2}\left[\frac{3}{2}\left(\alpha+\frac{1}{2}\right)+\frac{1}{2}\left(q+\frac{\alpha}{2}\right)\right]}{1-\beta\frac{1}{4}} \\
U^E(NHD) &= \frac{\frac{1}{2}\left[(1+q)\left(q+\frac{\alpha}{2}\right)+(1-q)\left(\alpha+\frac{1}{2}\right)\right]}{1-\beta q^2} \\
U^E(NDH) &= \frac{\frac{1}{2}\left[\frac{3}{2}\left(\alpha+\frac{1}{2}\right)+\frac{1}{2}\left(q+\frac{\alpha}{2}\right)\right]}{1-\beta\frac{q}{2}}
\end{aligned}
$$

Hence, if $q+\frac{\alpha}{2} \geq \alpha+\frac{1}{2}$ then as $q \in \left[\frac{1}{2},1\right]$ we have that $U^E(HH) \geq U^E(HD) = U^E(DH)$ and $U^E(HH) \geq U^E(AHD) \geq U^E(ADH)$. Similarly, if $\alpha+\frac{1}{2} \geq q+\frac{\alpha}{2}$ then $U^E(NDH) \geq U^E(HD) = U^E(DH)$ and $U^E(NDH) \geq U^E(AHD)$ and $U^E(NDH) \geq U^E(ADH)$. $\square$

Proof of Proposition 5. Given the result in Lemma 2, it is true that

$$U^E = \max\{U^E(HH), U^E(DD), U^E(NHD), U^E(NDH)\}.$$

Therefore, proceeding as in the proof of Proposition 4, after some tedious algebra we obtain the desired result. $\square$

Proof of Proposition 6. If the politician employs plan HH then the expected number of times he takes the right decision is given by

$$
\begin{aligned}
E(r^2) \;&=\; \underbrace{2\left[\underbrace{\left(\underbrace{\frac{1}{2}q}_{\theta^1=0}+\underbrace{\frac{1}{2}q}_{\theta^1=1}\right)}_{d^1=s^1}\underbrace{\left(\underbrace{\frac{1}{2}q}_{\theta^1=0}+\underbrace{\frac{1}{2}q}_{\theta^1=1}\right)}_{d^2=s^2}\right]}_{\#r^2=2} \\
&\quad+\underbrace{\underbrace{\left(\underbrace{\frac{1}{2}q}_{\theta^1=0}+\underbrace{\frac{1}{2}q}_{\theta^1=1}\right)}_{d^1=s^1}\underbrace{\left(\underbrace{\frac{1}{2}(1-q)}_{\theta^1=0}+\underbrace{\frac{1}{2}(1-q)}_{\theta^1=1}\right)}_{d^2\neq s^2}+\underbrace{\left(\underbrace{\frac{1}{2}(1-q)}_{\theta^1=0}+\underbrace{\frac{1}{2}(1-q)}_{\theta^1=1}\right)}_{d^1\neq s^1}\underbrace{\left(\underbrace{\frac{1}{2}q}_{\theta^1=0}+\underbrace{\frac{1}{2}q}_{\theta^1=1}\right)}_{d^2=s^2}}_{\#r^2=1} \\
&=\; 2q.
\end{aligned}
$$

The expected number of times he takes the right decision whenever he uses one of the other plans can be computed the same way as above.

Finally, as $q \in \left[\frac{1}{2}, 1\right]$ it is easy to see that $2q \geq \frac{1}{2} + q\left(\frac{1}{2}+q\right) \geq q\left(\frac{5}{2}-q\right) \geq \frac{3}{4}+\frac{q}{2} \geq 1$. $\square$